APPENDIX A
FHWA MEMORANDA TO NDDOT AND BIA

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U.S. Department
of Transportation

Federal Highway Administration

Memorandum

Subject: **ACTION:** Roadway Section Impounding Water Date: March 31, 2000

From: Vincent P. Schimmoller
Program Manager, Infrastructure

Reply to
Attn. of: HIPA-10

To: Mr. J. Michael Bowen
Division Administrator
Bismarck, North Dakota

On February 10, 2000, Senators Byron Dorgan and Kent Conrad with Representative Earl Pomeroy conducted a meeting of all involved parties on the emergency road situation at Devils Lake, North Dakota. Of primary concern to all were the safety issues associated with those roadway sections impounding water. The outcome of that meeting was for the Federal Highway Administration (FHWA) to work with the U.S. Army Corps of Engineers (USACE) and the North Dakota Department of Transportation to outline a process to assess safety concerns for roadway sections impounding water. We were to report to the North Dakota congressional delegation on February 18, 2000.

The report to the congressional delegation included that after evaluating the circumstances of those roadway sections impounding water, there is cause for concern due to the differential pressure head, and the resultant potential for sudden failure of the roadway embankment. This concern grows in significance with continued grade raises because of the mounting differential pressures imposed on roadway embankments. In the absence of any other criteria, the USACE indicated they could only assure safety of these sections if the roadway embankments had been constructed similar to the levee system built to protect the city of Devils Lake. Such is not the case. A preliminary estimate of costs to build similar sections for affected roadways was placed as high as $50 million. The USACE has looked at levee needs in the area beyond the city of Devils Lake and has concluded that they could not justify Corps expenditures for the construction of additional levees. From the highway program standpoint, construction of such levees is outside of our authority in 23 U.S.C. and the purpose and mission of the highway trust fund.

We reported, therefore, that the FHWA would no longer participate in further grade raises for those roadway sections currently impounding water. However, if these sections were equalized, thus eliminating the differential pressure concerns, or if the sections were modified by others to address safety concerns, we would reconsider our position to participate in future grade raises, should they become necessary.

Please feel free to call. We are available to further clarify and discuss this determination with you.

U.S. Department of Transportation
Federal Highway Administration

400 Seventh St., S.W.
Washington, D.C. 20590

MAY 22 2001

Refer to: HFPD-5

Ms. Cora L. Jones
Regional Director
Great Plains Regional Office
Bureau of Indian Affairs
115 Fourth Avenue, SE.
Aberdeen, South Dakota 57401

Dear Ms. Jones:

We are in receipt of your April 20, 2001 letter, wherein you requested clarification on what design work is eligible for the recently approved funds ($426,000) for Emergency Relief for Federally Owned Roads (ERFO) disaster ND98-1-BIA. We offer the following guidance towards a design of a long-range transportation solution and the need to secure other funding sources to deal with Devils Lake's rising water levels for the residents of the Spirit Lake Indian Reservation.

We are very concerned about the safety of the roadways since the U.S. Army Corps of Engineers (COE) has determined that raising the grade on the existing Bureau of Indian Affairs (BIA) roads acting as dams will not provide a safe structure for use by tribal members and the general public. Thus, using ERFO funding for the continued raising of the roadway embankments acting as dams is not an acceptable solution, and our Damage Survey Report approval of grade raises for BIA Routes 1, 2, 4, and 5 sections which are acting as dams is withdrawn.

The ERFO funds ($426,000) previously provided can only be used for:

- Design and construction of grade raises which includes equalizing the differential pressure head along the causeway for BIA Routes 1, 2, 4, and 5; or
- Design and construction of the structural roadway sections on COE approved dams or levees.

If the BIA and tribe want to pursue the design and construction of relocated roads that are engineered as dams or levees, then the ERFO Program will fund the preliminary engineering costs. However, the ERFO Program will not fund the levee or dam construction costs, but only the cost of the structure roadway section associated with either the dam or levee system. The preliminary design should identify the limits of disturbance caused by the structure footprint of the dams or levees with the BIA's current primary transportation system, tribal facilities, tribal member homes, and trust lands.

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Based on a high preliminary cost estimate by the COE to build this type of alternative structure, we consider this solution to be far from the intent and funding available through the ERFO Program. We suggest that the BIA investigate other sources of funding and actively work with the COE to develop a funding plan for these structures.

It is our understanding that you will be in the Washington, DC, area the week of June 4, 2001, and may be available to meet with our staff to further clarify both agencies' concerns and discuss long-term transportation solutions. Please have your office call us to arrange this meeting. Also, please direct any questions to Mr. Butch Wlaschin, Director, Office of Program Development, at 202-366-9478.

Sincerely yours,

Arthur E. Hamilton, P.E.
Program Manager, Federal Lands Highway

cc: Mr. Terrence Virden, Director, Office of Trust Responsibilities, BIA, Washington, DC
Mr. LeRoy Gishi, Chief, Division of Transportation, BIA, Washington, DC
Mr. Larry Smith, Division Engineer, CFLHD, Lakewood, CO

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APPENDIX B
SECTION 1937 OF SAFETEA-LU

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SEC. 1937. <<NOTE: North Dakota.>> ROADS IN CLOSED BASINS.

(a) In General.--The Secretary shall use funds made available to carry out section 125 of title 23, United States Code, through advancement or reimbursement, without further emergency declaration, to construct such measures as the Secretary determines to be necessary for the continuation of roadway services, or the impoundment of water to protect roads, or both, at Devils Lake in the State of North Dakota, as the Secretary determines to be appropriate.

(b) Requirements.--The Secretary shall carry out construction under subsection (a) in accordance with--

(1) the options and needs identified in the report of the Devils Lake Surface Transportation Task Force of the Federal Highway Administration dated May 4, 2000, and entitled ``Roadways Serving as Water Barriers'';

(2) any needs relating to Devils Lake identified after May 4, 2000; and

(3) any monitoring, study, or design or preliminary engineering associated with evaluating or constructing the measures.

(c) Affected Areas.--The Secretary shall carry out construction under this section in an area that has been the subject of an emergency declaration issued during the period beginning on January 1, 1993, and ending on the date of enactment of this Act.

(d) Funding.--

(1) In general.--Except as provided in paragraph (2), to the extent that expenditures relating to construction under this section could not be made pursuant to any other authority under section 125 of title 23, United States Code, the expenditures shall not exceed--

(A) $10,000,000 during any fiscal year; and

(B) a total amount of $70,000,000.

[[Page 119 STAT. 1511]]

(2) Exception.--Nothing in paragraph (1) limits any expenditure with respect to--

(A) emergency relief in response to a development occurring after the date of enactment of this Act; or

(B) an authority under any other provision of law (including section 125 of such title).

(e) Effect of Section.--Nothing in this section authorizes or provides funding for the construction, operation, or maintenance of an outlet at Devils Lake in the State of North Dakota.

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APPENDIX C

10-17-07 HYDRAULICS REVISED MEMORANDUM

AND

3-25-2008 GROUNDWATER ASSESSMENT MEMORANDUM

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U.S. Department
of Transportation
Federal Highway Administration

Memorandum

TO: Jennifer Corwin

FROM: Roger Kilgore

DATE: October 17, 2007

CC: Gary Strike

RE: Effects of Roads Acting as Dams and Levees on Devils Lake Water Surface Elevation

I have performed an assessment of the effect that constructing roads as dams and levees would have on the water surface elevation and potential accelerated discharge to the Sheyenne River. The data used for these analyses includes information from the USGS (Vechhia, 2002) and the USACE (USACE, 2007). This represents an update of my analysis reported in a technical memorandum dated April 12, 2007 to include the more expanded alternative 2D in the St. Michaels area.

Introduction

The first step is to determine an appropriate condition or conditions for assessing the effects. Since it is highly speculative to state what rates of increase may be observed in Devils Lake, I have chosen the two inflow design flood (IDF) conditions developed by the Corps of Engineers (2007). These contain known inflow characteristics and starting water surface elevations. The first condition assumes a starting water surface elevation of 1447 feet with the IDF occurring over 120 days. The second condition assumes a starting water surface elevation of 1459 feet with the same IDF.

The second step is to determine the elevation-volume relationship for areas potentially protected by proposed roads acting as dams and levees. Elevation-area data was acquired from the Federal Lands GIS group and converted to elevation-volume for the most comprehensive suite of alternatives in the Acorn Ridge and St. Michaels areas. Other alternatives combinations would have a lesser effect.

The third step is to evaluate how much more quickly discharges to the Sheyenne River might be observed and to what elevation the lake would rise under these conditions.

Results

The elevation-area data ranged from a total area protected at elevation 1445 ft of 4,011 acres ranging up to 6,704 acres protected at an elevation of 1460 ft. These areas are 3.2 and 2.3 percent, respectively, of the Devils Lake/Stump Lake areas.

Under condition 1, the USACE (2007) determined that with the inflow design flood the water surface elevation of Devils Lake would rise from 1447 to 1455 feet in 120 days. No outflow to the Sheyenne River would be experienced during this hypothetical event. With the most comprehensive suite of dams and levees, the elevation of 1455 ft would be reached 5.2 days

earlier than without any protection. The elevation reached would be 0.2 ft higher or 1455.2 ft. No discharge to the Sheyenne River would occur.

Under condition 2, the USACE (2007) determined that with the inflow design flood the water surface elevation of Devils Lake would rise from 1459 to 1462.8 in 120 days. Since the starting water surface elevation is 1459, discharge into the Sheyenne River would begin immediately under this condition. With the most comprehensive suite of dams and levees, the elevation of 1462.8 ft would be reached 3.5 days earlier than without any protection. The elevation reached would be 0.1 ft higher or 1462.9 ft.

In terms of overall volumes protected, at the outlet elevation of 1,459 ft the maximum volume protected by the proposed project is 130,000 ac-ft. If the equalized sections of ND 57, BIA 1, and ND 20 (Spring Lake) are also included the volume increases to 170,000 ac-ft.

Many other conditions could be conceived. However, since the protected area is less than 3.2 percent of the total Devils Lake system, the effects of the project on lake levels and discharge to the Sheyenne River will be minimal as is shown with the two conditions analyzed.

References

USACE, 2007. "Devils Lake Roads as Dams Documentation Preliminary Results," Project memorandum, February 23.

Vecchia, Aldo V., 2002. "Simulation of a Proposed Emergency Outlet from Devils Lake, North Dakota," Water-Resources Investigations Report 02-4042, United States Geological Survey.

U.S. Department
of Transportation
Federal Highway Administration

Memorandum

TO: Gary Strike

FROM: Roger Kilgore

DATE: March 25, 2008

CC:

RE: Groundwater assessment

Introduction

This memo provides an assessment of the potential effects on groundwater levels resulting from changes in the water surface elevation of Devils Lake. The focus is on areas where an equalization strategy has been considered: 1) Zone 1 (near ND 57 and BIA 1) and 2) Zone 3 (near Spring Lake). Figures 1 and 2 show these areas.

The analysis uses well and water level data obtained from the North Dakota State Water Commission (NDSWC). The field data were collected by either the NDSWC or the United States Geological Survey (USGS) and are limited to the period between 1968 and 1994. The wells used in the analysis are shown on Figures 1 and 2 and are described in Tables 1 and 2 for Zone 1 and Zone 3, respectively. All water level data available for each selected well was used in the analysis. The tables report the purpose for the well installation and the year installed. The tables also report the ground elevation at the well and the elevation of the center of the screen in the well. The latter reflects the location of the ground water layer being measured by the well. The Spirit Lake Nation has additional well monitoring data displayed on its website, including some data subsequent to 1994. However, these data are not in tabular form and could not be readily used.

Several references were reviewed in the preparation of this analysis. These include, but are not limited to Bluemle (2000), Pusc (1993), Pusc (1998), Randich (1977), and Vining and Cates (2006).

The analysis is reported in two sections. The first section describes potential consequences of lake level changes on ground water levels. The second section specifically addresses potential effects that the equalization project alternative may cause in addition to the non-project related consequences of lake level changes.

Potential consequences of lake level changes

The Devils Lake area includes several named aquifers as well as many unnamed glacial till, sand sediment, and lake clay deposits that store ground water. The named aquifers of potential interest include the Spiritwood, Warwick, and Tokio aquifers.

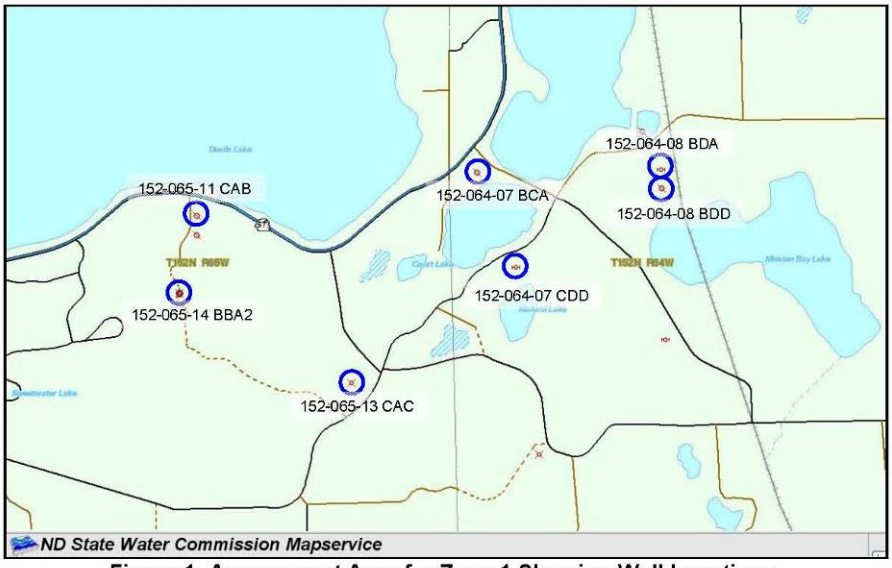

Figure 1. Assessment Area for Zone 1 Showing Well Locations.

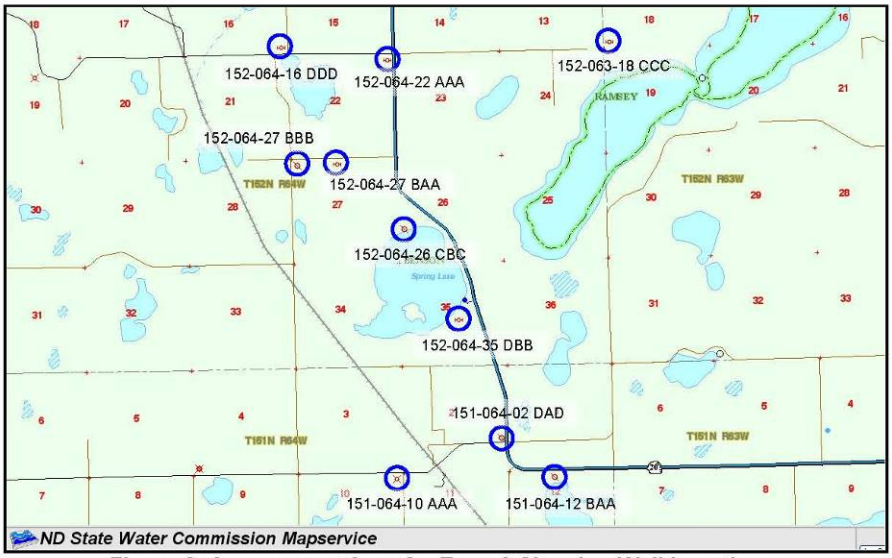

Figure 2. Assessment Area for Zone 3 Showing Well Locations.

Table 1. Zone 1 Well Summary.

Location	County	Aquifer	Purpose	Year	Source	Surface Elevation (ft)	Screen Elevation (ft)
152-064-07 BCA	Benson	Spiritwood	Observation Well	1968	NDSWC	1432.1	1313.6
152-064-07 CDD	Benson	Till	Observation Well - Plugged	1986	NDSWC	1442.2	1416.7
152-064-08 BDA	Benson	Sand Sediments	Observation Well - Plugged	1986	NDSWC	1438.0	1378.0
152-064-08 BDD	Benson	Sand Sediments	Observation Well	1986	NDSWC	1420.2	1408.2
152-065-11 CAB	Benson	Till	Observation Well	1986	NDSWC	1449.7	1434.2
152-065-13 CAC	Benson	Spiritwood	Observation Well - Destroyed	1969	NDSWC	1530.0	1390.0
152-065-14 BBA2	Benson	Clay Sediments	Observation Well	1986	NDSWC	1733.0	1525.0

Table 2. Zone 2 Well Summary.

Location	County	Aquifer	Purpose	Year	Source	Surface Elevation (ft)	Screen Elevation (ft)
151-064-02 DAD	Benson	Undefined	Observation Well	1986	NDSWC	1493.6	1460.6
151-064-10 AAA	Benson	Warwick	Observation Well - Destroyed	1967	NDSWC	1485.7	1421.2
151-064-12 BAA	Benson	Undefined	Observation Well	1986	NDSWC	1471.3	1456.3
152-063-18 CCC	Benson	Lake Clay Sed.	Observation Well - Plugged	1986	NDSWC	1456.4	1420.9
152-064-16 DDD	Benson	Lake Clay Sed.	Observation Well - Plugged	1986	NDSWC	1493.7	1478.2
152-064-22 AAA	Benson	Till	Observation Well – Plugged	1986	NDSWC	1479.7	1434.2
152-064-26 CBC	Benson	Lake Clay Sed.	Observation Well	1986	NDSWC	1447.5	1432.0
152-064-27 BAA	Benson	Till	Observation Well – Plugged	1986	NDSWC	1440.7	1430.2
152-064-27 BBB	Benson	Warwick	Observation Well	1967	NDSWC	1452.8	1394.3
152-064-35 DBB	Benson	Till	Observation Well – Plugged	1986	NDSWC	1442.1	1431.6

Zone 1

Figure 1 shows the location of wells included in this analysis. As is documented in Table 1, some of these wells tap the Spiritwood aquifer while others tap into glacial till, sand sediments, or clay sediments.

According to Pusc (1993), "water level fluctuations in the Spiritwood aquifer are a combined result of: (1) fluctuations in the height of the regional discharge area (Devils Lake), (2) recharge from precipitation, and (3) loading and unloading effects caused by fluctuating lake levels." Increases in lake levels may increase water level in an aquifer by reducing the slope of the ground water hydraulic gradient (mechanism 1) or by essentially compressing the aquifer and reducing void spaces resulting from the weight of water in the lake (mechanism 2). Conversely, decreases in lake levels may decrease water levels in the aquifer by a reversal of these effects. The second mechanism, precipitation recharge, is independent of lake levels. The degree to which one or more of these mechanisms may influence ground water levels depends on the aquifer configuration; distance and depth relative to the lake; and local recharge and losses.

Figure 3 provides an example of the variability of the connection between the lake and Spiritwood aquifer. The 152-064-07 BCA well, which is located adjacent to the lake shows a very close connection with the lake, while the 152-062-13 CAC well, which is further from the lake shows little evidence of a connection even though the screened elevation of the well ((1390 ft) is below the lake surface. Therefore, the mechanisms identified by Pusc will vary considerably in the Spiritwood aquifer.

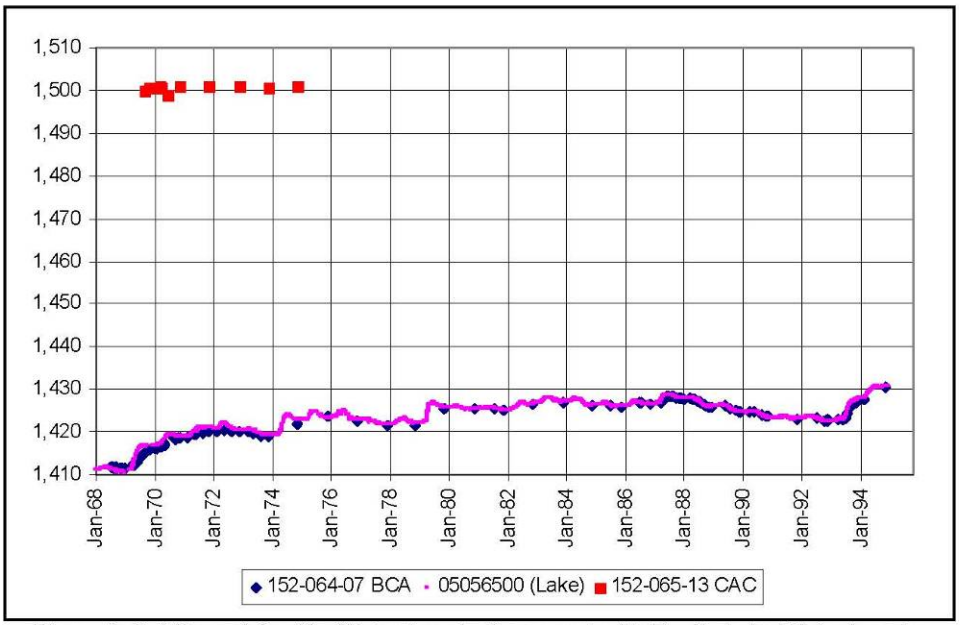

Figure 3. Spiritwood Aquifer Water Levels Compared with Devils Lake Water Levels.

For other aquifers, including the Warwick and Tokio, Pusc (1993) observes that "ground water flow in these aquifers is mainly towards nearby coulees, lakes, or the Sheyenne River Valley. As such, these aquifers interact very little with Devils Lake…"

Named aquifers generally represent the larger formations. However, there are numerous smaller formations of glacial till, sand sediments, and clay sediments which store water and have been tapped for water supply. For locations shown in Figure 1, water levels for several wells in these types of formations are summarized in Figure 4. Unfortunately, only a short period of record for the wells is available.

Two of the wells in Figure 4 (152-065-11 CAB and 152-064-07 CCD) tap glacial till and show more significant water level changes when compared to the lake level. Although there may be a hydraulic connection, these wells appear to be more influenced by local recharge and losses. The fact that they both generally rise and fall with the lake may suggest a connection, but may also suggest that the wells are responding to the same rainfall and evapotranspiration patterns as the lake itself.

Two additional wells shown in Figure 4 (152-064-08 BDA and 152-064-08 BDD) tap into sand sediments and display water levels below Devils Lake. For these two wells, there is much less variability suggesting that the higher lake levels may supply water and strongly influence their level. In fact, the well water levels appear less variable than the lake.

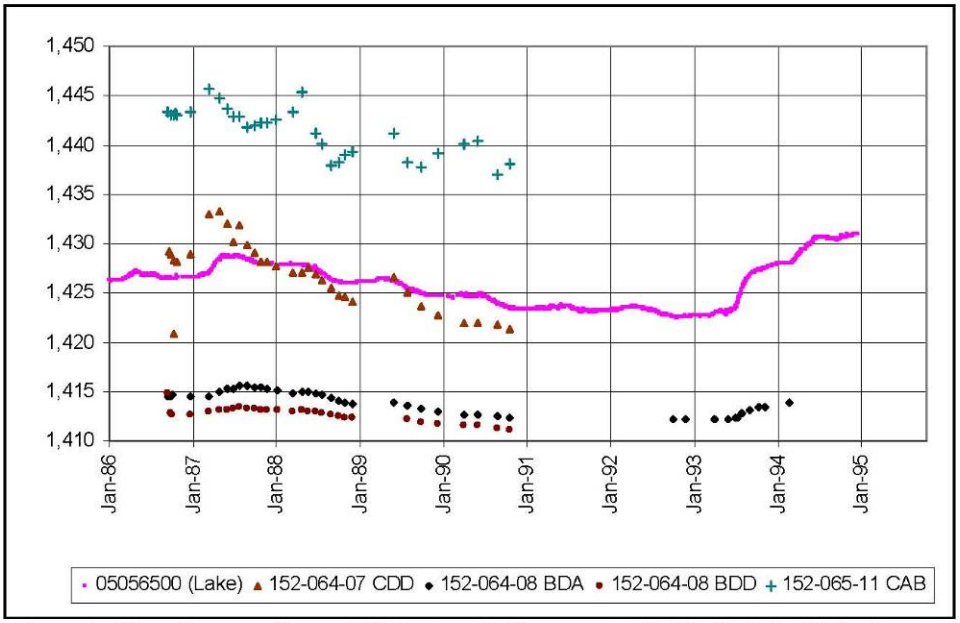

Figure 4. Miscellaneous Ground Water Levels Compared with Devils Lake Water Levels.

As with the Spiritwood aquifer, there may not be any conclusions that are broadly applicable relating water levels in the lake with those in wells tapping glacial till, sand sediments, and clay sediments. A potential connection does exist, but varies with distance, depth, and local recharge/losses.

Zone 3

Figure 2 shows the location of wells included in this analysis. As is documented in Table 2, some of these wells tap the Warwick aquifer while others tap into glacial till, lake clay sediments, or undefined layers.

Figure 5 shows the water levels of two wells tapping into the Warwick aquifer and compares them to the Devils Lake water level. Both wells exhibit little or no connection to the rising Devils Lake in 1968 through 1979. However, beginning in 1980, well water levels parallel Devils Lake levels. This change in behavior may suggest that the wells are independent of lake levels below 1425 feet, but not above this level because flows from the Warwick aquifer to the lake are limited by the lake level.

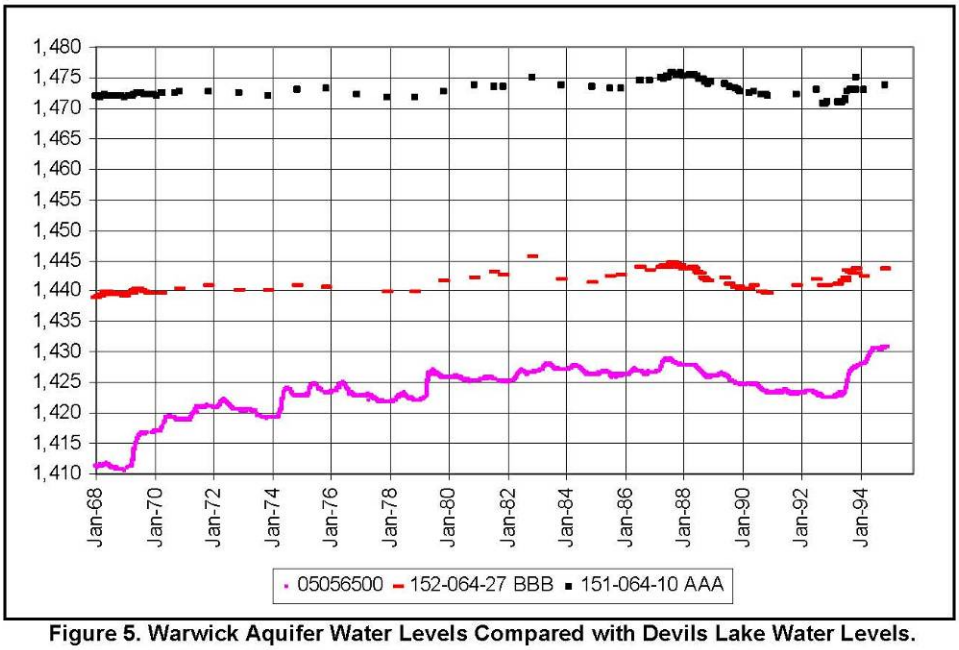

Figure 5. Warwick Aquifer Water Levels Compared with Devils Lake Water Levels.

Similar to Zone 1, there are numerous smaller formations of glacial till, lake clay sediments, and undefined layers in Zone 3 that store water and have been tapped for water supply. For locations shown in Figure 2, water levels for several wells in these types of formations are summarized in Figure 6. Unfortunately, only a short period of record for the wells is available.

As for the smaller formations in Zone 1, there may not be any conclusions that are broadly applicable relating water levels in the lake with those in wells tapping these smaller formations. A potential connection does exist, but varies with distance, depth, and local recharge/losses.

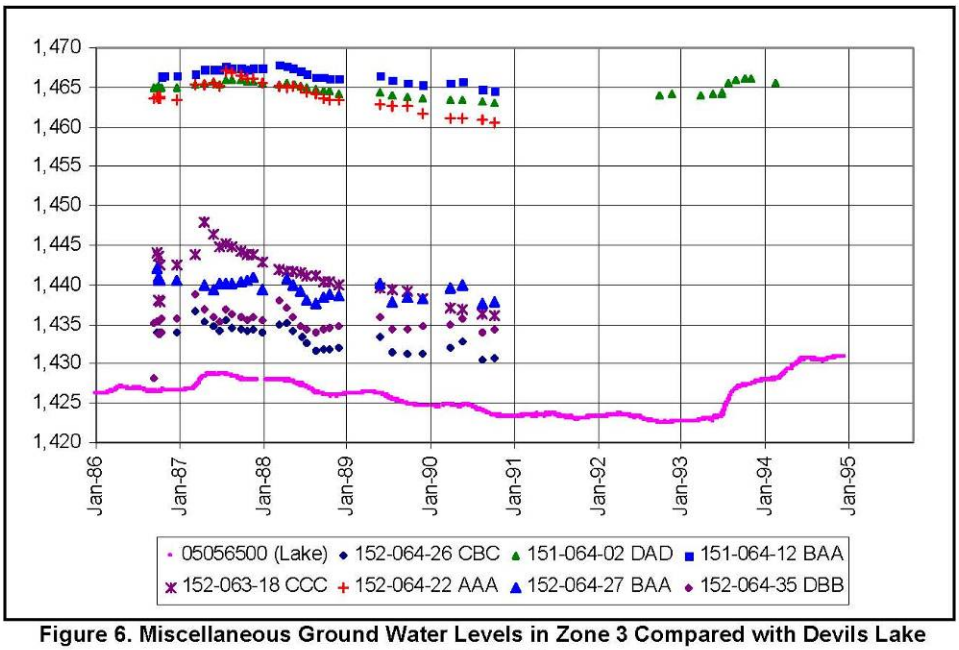

Figure 6. Miscellaneous Ground Water Levels in Zone 3 Compared with Devils Lake Water Levels.

Potential Effects of Equalization

The preceding section demonstrates the highly variable relationship between aquifers in the vicinity of Devils Lake and the water levels in Devils Lake. Devils Lake may supply water to an aquifer or it may be a recipient of water lost from an aquifer. Such relationships, depending on proximity of the aquifer and the nature of the relationship, may strongly suggest a hydraulic connection. Conversely, other aquifers are clearly independent of Devils Lake. Intermediate to these two cases are aquifers for which water levels appear to be connected, but in fact the aquifer and lake are merely responding to the same rainfall and evapotranspiration patterns and, in fact, are not connected.

Regardless of the proposed project, most of the relationships between ground water and lake levels will be unchanged by the proposed project. In the areas of Zone 1 and Zone 3, equalization is a project option. With this option, the lake is allowed access to expand in selected locations rather than being confined by an impermeable embankment.

Considering the highly variable context discussed in the previous section, a few observations are apparent:

1. Aquifers connected to the lake may become more closely connected (shorter hydraulic connection) because the lake is expanded. This would mean that the water surface elevations would become closer in absolute terms. In other words, for those locations with a connection, those connections will be enhanced.
2. Aquifers unconnected to the lake will likely remain unconnected. However, there may be some lake level threshold at which a connection becomes newly established.
3. Based on observation well variations, effects of equalization should become apparent relatively quickly, that is, within a year.

References

Bluemle, John P., 2000. "The Face of North Dakota," North Dakota Geological Survey, Educational Series 26.

Pusc, Steve W., 1993. "The Interaction Between Ground Water and a Large Terminal Lake, Devils Lake, North Dakota: Hydrogeology of the Devils Lake Area," North Dakota State Water Commission, Water Resources Investigation #13.

Pusc, Steve W., 1998. "Hydrogeology of the Shallow Water Table at the City of Devils Lake, North Dakota," North Dakota State Water Commission, Water Resources Investigation #34.

Randich, P.G., 1977. "Ground-water Resources of Benson and Pierce Counties," USGS, County Ground-water Studies 18 – Part III (North Dakota State Water Commission), Bulletin 59 – Part III (North Dakota Geological Survey).

Vining, Kevin C. and Steven W. Cates, 2006. "Summary of Surface-Water Quality, Ground-Water Quality, and Water Withdrawals for the Spirit Lake Reservation, North Dakota," USGS Open File Report 2006-1144.

APPENDIX D
AVAILABLE TECHNICAL REPORTS

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Available Technical Reports

A number of technical reports were prepared in support of this EA. These reports include:

ERO Resources Corporation. 2006. Devils Lake Wetland Delineation Report. Phase II. ND ERFO 1 (992). Prepared for Federal Highway Administration.

ERO Resources Corporation. 2007a. Devils Lake Biological Assessment and Report. Phase II. ND ERFO 1 (992). Prepared for Federal Highway Administration.

ERO Resources Corporation. 2007b. Devils Lake Cultural Resources Survey Report. Phase II. ND ERFO 1 (992). Prepared for Federal Highway Administration.

ERO Resources Corporation. 2007c. Devils Lake Transaction Screen Report. Phase II. ND ERFO 1 (992). Prepared for Federal Highway Administration.

ERO Resources Corporation. 2007d. Devils Lake Wetland Delineation Report. Phase IIB. ND ERFO 1 (992). Prepared for Federal Highway Administration.

ERO Resources Corporation. 2007e. Devils Lake Biological Assessment and Report. Phase IIB. ND ERFO 1 (992). Prepared for Federal Highway Administration.

ERO Resources Corporation. 2007f. Devils Lake Cultural Resources Survey Report. Phase IIB. ND ERFO 1 (992). Prepared for Federal Highway Administration.

ERO Resources Corporation. 2007g. Devils Lake Transaction Screen Report. Phase IIB. ND ERFO 1 (992). Prepared for Federal Highway Administration.

ERO Resources Corporation. 2007h. Devils Lake Wetland Delineation Report. Phase IIC. ND ERFO 1 (992). Prepared for Federal Highway Administration.

ERO Resources Corporation. 2007i. Devils Lake Biological Assessment and Report. Phase IIC. ND ERFO 1 (992). Prepared for Federal Highway Administration.

FHWA. 2007a. Effects of Roads Acting as Dams and Levees on Devils Lake Water Surface Elevation Technical Memorandum.

FHWA. 2007b. Social and Economic Impact Study. Devils Lake Phase II 1(992) Roads-Acting-as-Dams Project.

FHWA. 2008. Groundwater Assessment Technical Memorandum.

USACE. 2007a. Hydraulics and Hydrology Design Criteria Memorandum: HHDCM. Hydraulics and Hydrology Dam Safety Analysis.

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APPENDIX E

ESTIMATED INUNDATION IMPACTS TO RESIDENCES

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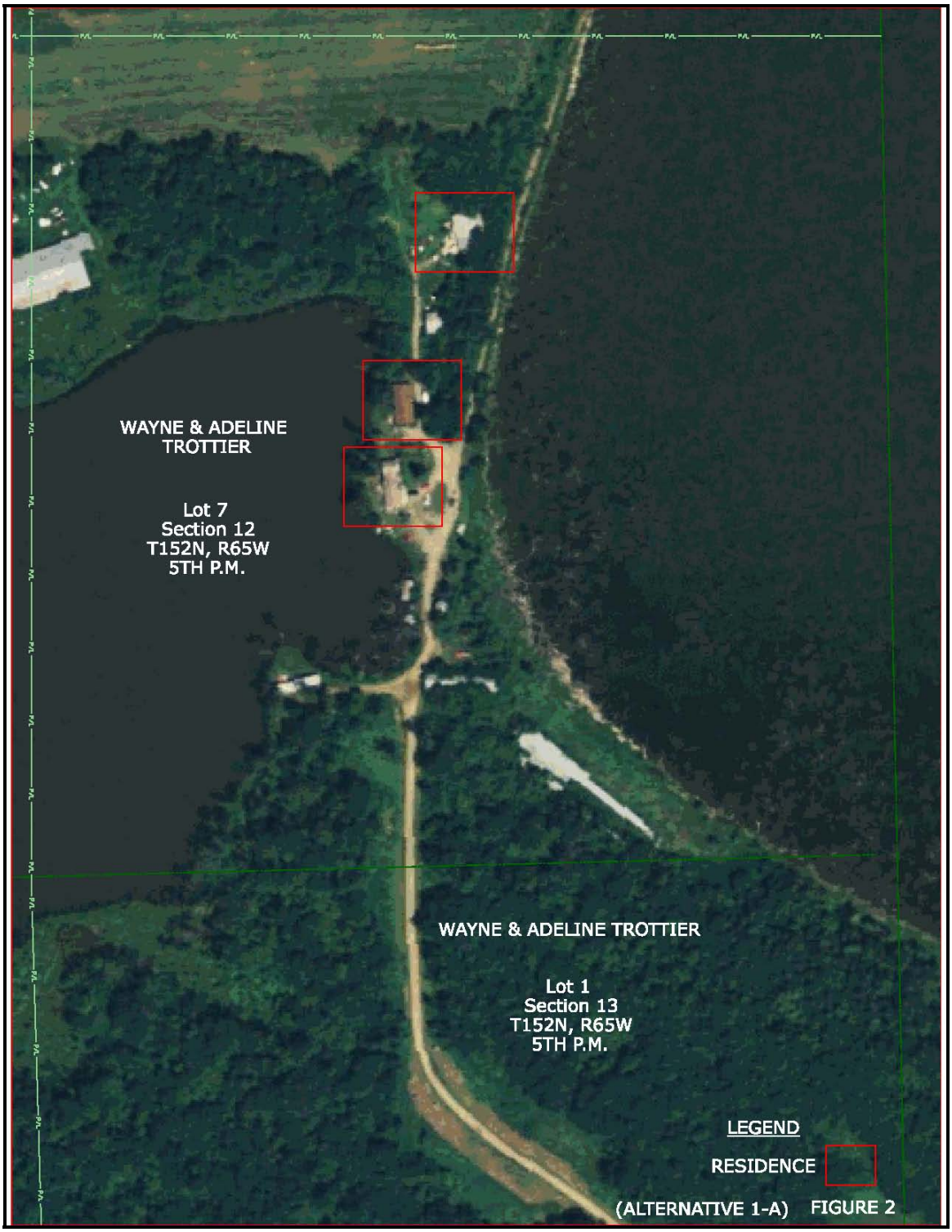
ND ERFO 1(992)
EQUALIZATION 1449'
RESIDENTIAL AND BUSINESS RELOCATION
FIG. 4
FIG. 1
FIG. 2
FIG.3


ND 57
BLADHOLM BROTHERS INC
(POSSESSARY INTEREST)
Lot 2
Section 12
T152N, R65 W
5TH P.M.
ALLOT. NO. 728
Lot 6
Section 12
T152N, R65W
5TH P.M.
ALLOT. NO. 912
LEGEND
RESIDENCE
(ALTERNATIVE 1-A)
FIGURE 1



(ALTERNATIVE 1-A) FIGURE 2


EDWARD GREEN
ALLOT. NO. 877
Lot 3
Section 24
T152N, R64W
5TH P.M.
LEGEND
RESIDENCE
(ALTERNATIVE 3-A)
FIGURE 3


RAYMOND L & ROXANNE HAWLEY
NELSON & REBECCA STAVE
JOHN P & VIOLA M SCHNEIDER
CLINTON & JULIE DEVIER
LEO RICHARD SWANSON
RUTH M QUAM
LEO SWANSON
LEO & RUTH SWANSON
ND 57/20
MILITARY RD
LEGEND
RESIDENCE
RESIDENCE IMPACT
BUSINESS
(ALTERNATIVE 4-A) FIGURE 4

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APPENDIX F

ESTIMATED RIGHT-OF-WAY ACQUISITION IMPACTS TO RESIDENCES

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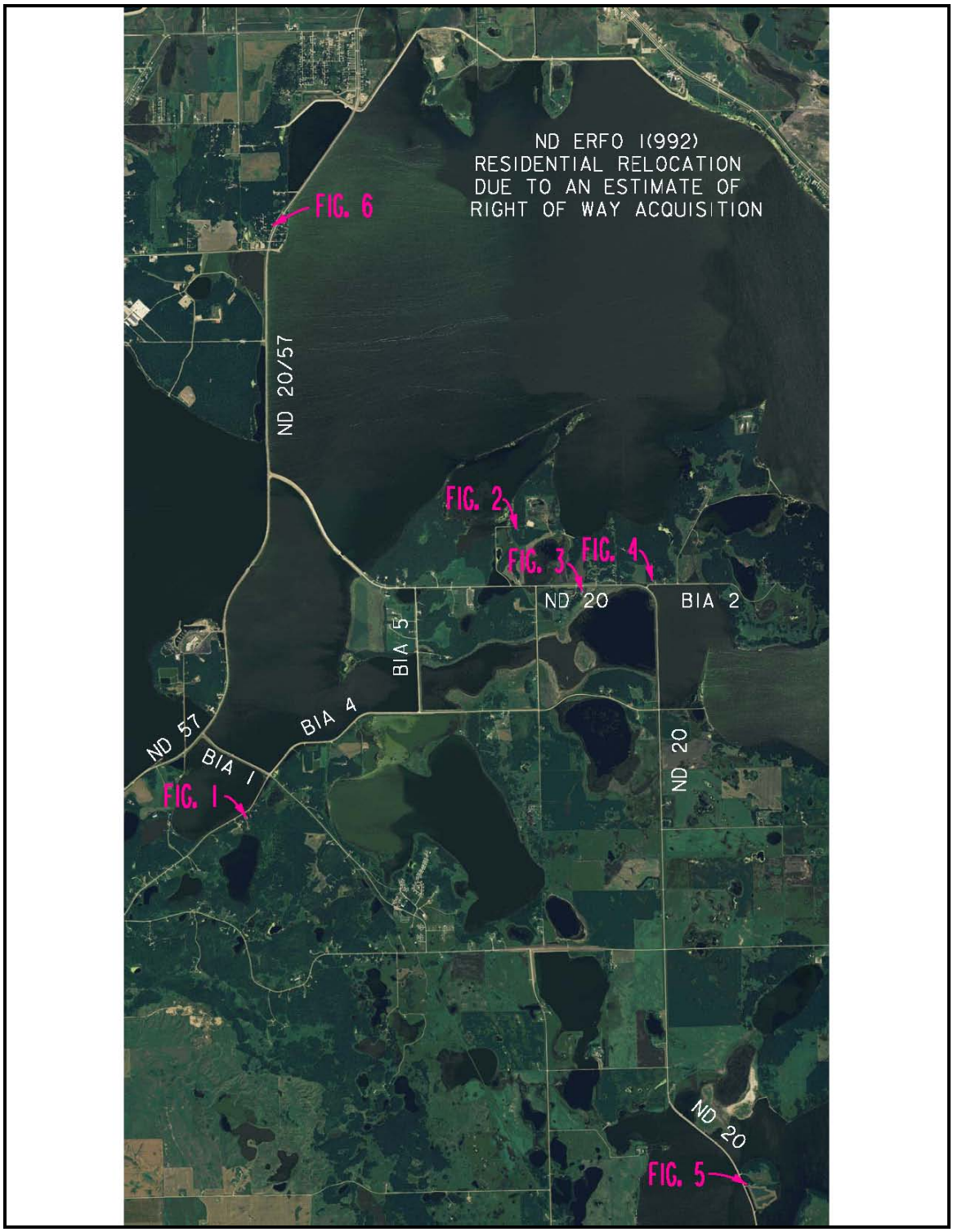
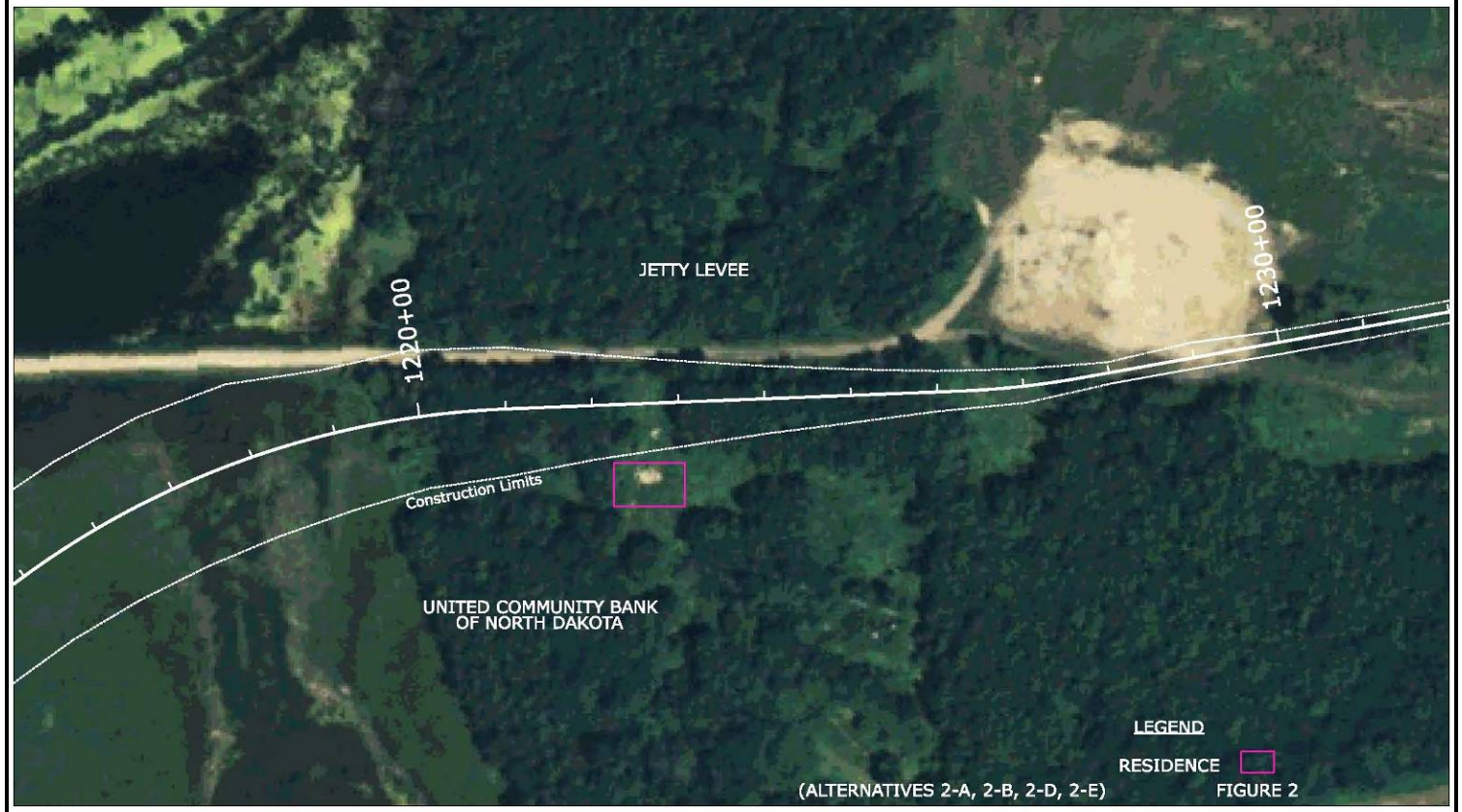
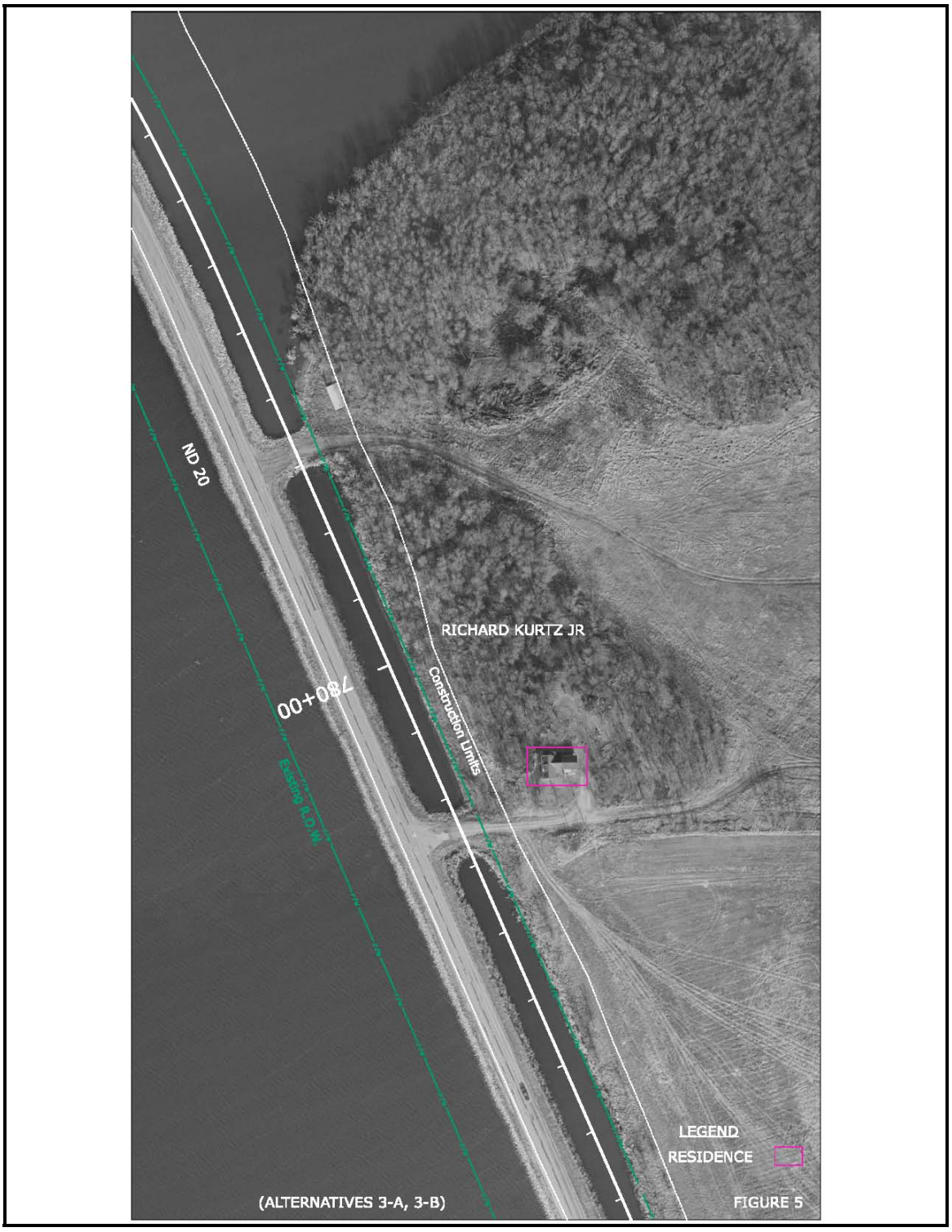

ND ERFO 1(992)
RESIDENTIAL RELOCATION
DUE TO AN ESTIMATE OF
RIGHT OF WAY ACQUISITION
FIG. 6
ND 20/57
FIG. 2
FIG. 3
FIG. 4
ND 20
BIA 2
BIA 5
BIA 4
ND 57
BIA 1
FIG. 1
ND 20
ND 20
FIG. 5


380+00
Existing R.O.W.
BIA 4
320+00
Construction Limits
ALLOT. NO. 222
LEGEND
RESIDENCE
(ALTERNATIVE 1-A)
FIGURE 1

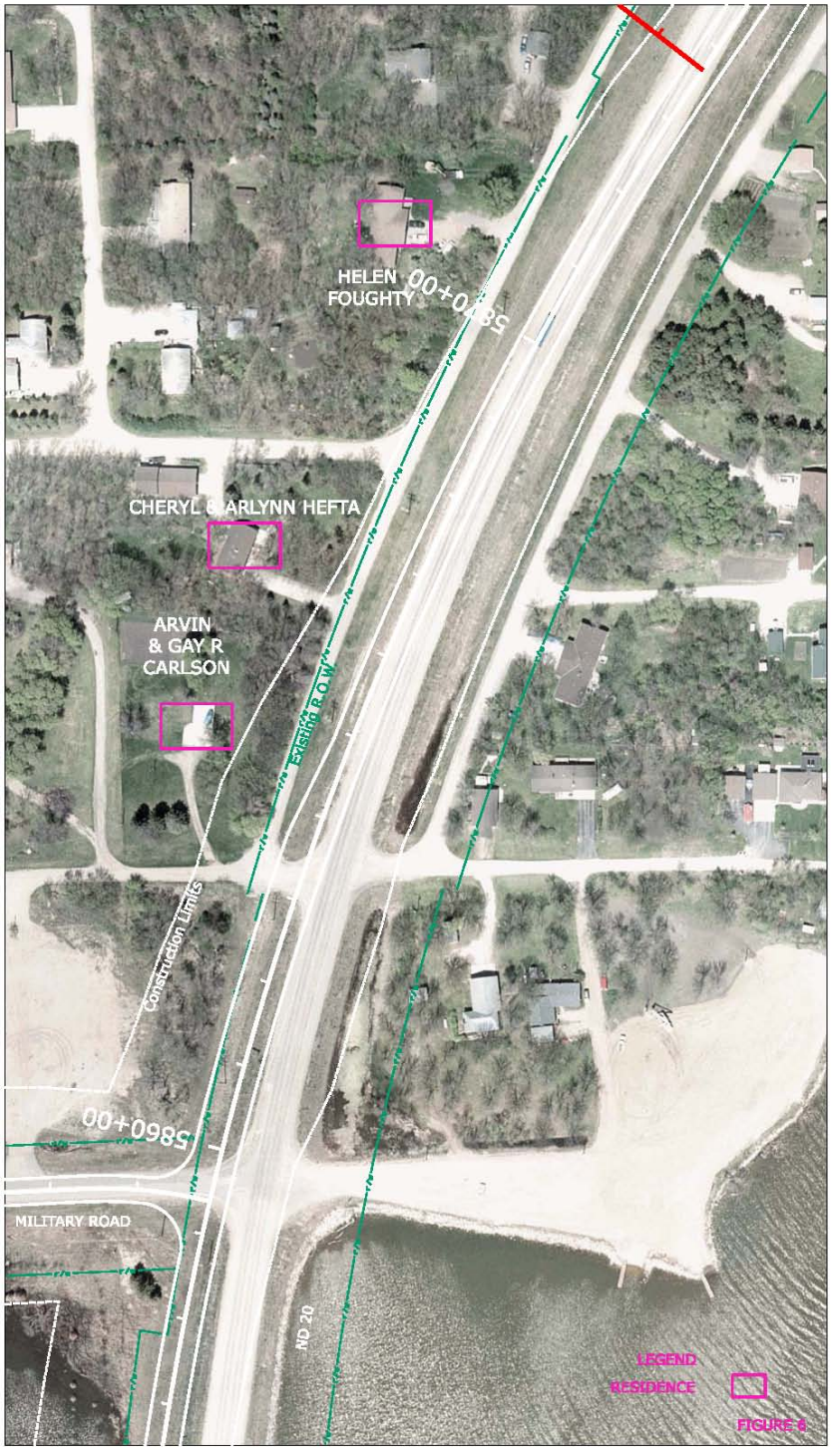

JETTY LEVEE
1220+00
1230+00
Construction Limits
UNITED COMMUNITY BANK
OF NORTH DAKOTA
LEGEND
RESIDENCE
(ALTERNATIVES 2-A, 2-B, 2-D, 2-E)
FIGURE 2


ND 20
Existing R.O.W.
Construction Limits
5140+00
5130+00
DUANE & BERNADINE NELSON
LEGEND
RESIDENCE
(ALTERNATIVE 2-C)
FIGURE 3


ALLOT. NO. 385
210+00
Construction Limits
Existing R.O.W.
N 0° 45' 01" W
BIA 2
STATE OF
NORTH DAKOTA
DOT
ND 20
LEGEND
RESIDENCE
(ALTERNATIVES 2-A, 2-B, 2-C)
FIGURE 4


ND 20
RICHARD KURTZ JR
780+00
Construction Limits
Existing R.O.W.
LEGEND
RESIDENCE
(ALTERNATIVES 3-A, 3-B)
FIGURE 5


HELEN FOUGHTY
CHERYL & ARLYNN HEFTA
ARVIN & GAY R CARLSON
Existing R.O.W.
Construction Limit
5860+00
MILITARY ROAD
ND 20
LEGEND
RESIDENCE
(ALTERNATIVES 4-A, 4-B)
FIGURE 6


HELEN FOUGHTY
CHERYL & ARLYNN HEFTA
ARVIN & GAY R CARLSON
Existing R.O.W.
Construction Limits
5860+00
MILITARY ROAD
ND 20
LEGEND
RESIDENCE
FIGURE 6